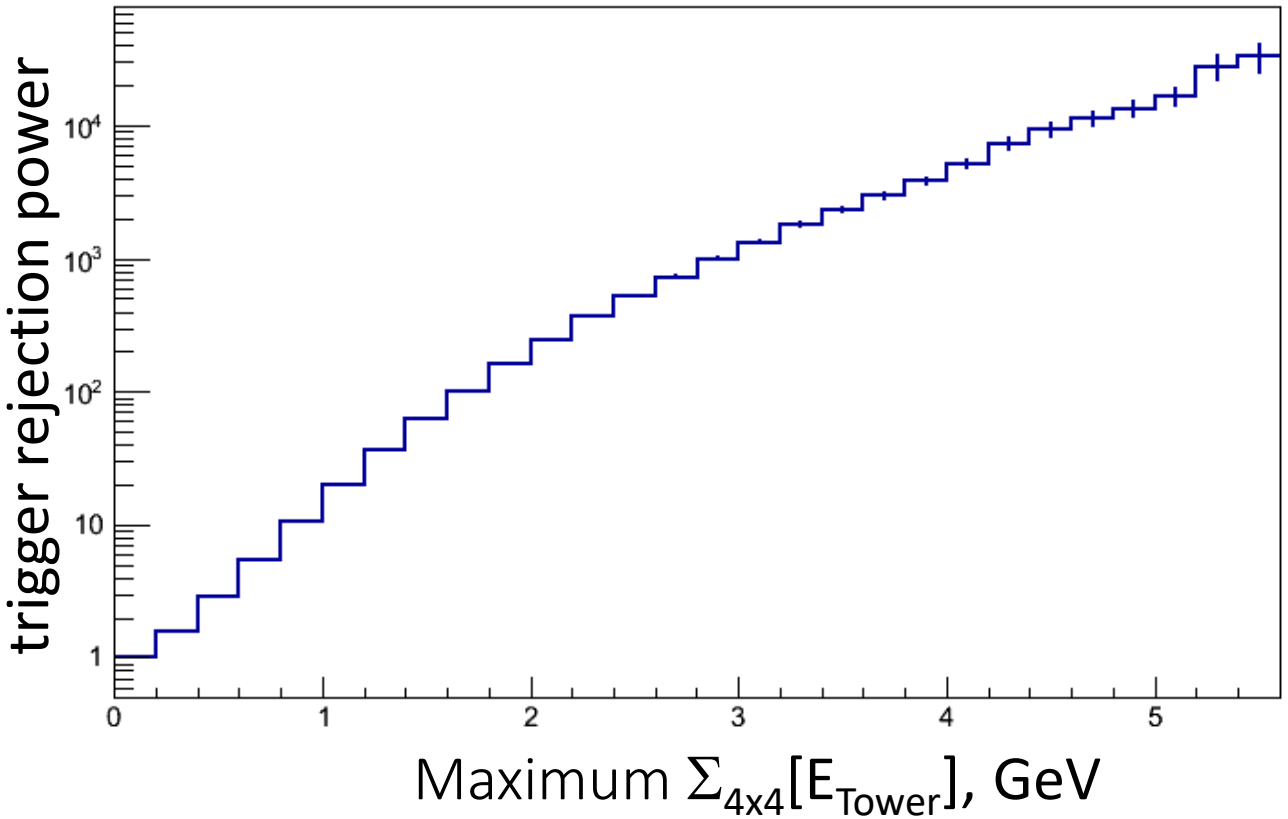
J/ψ in sPHENIX p+p collisions
Trigger efficiency and expected yields

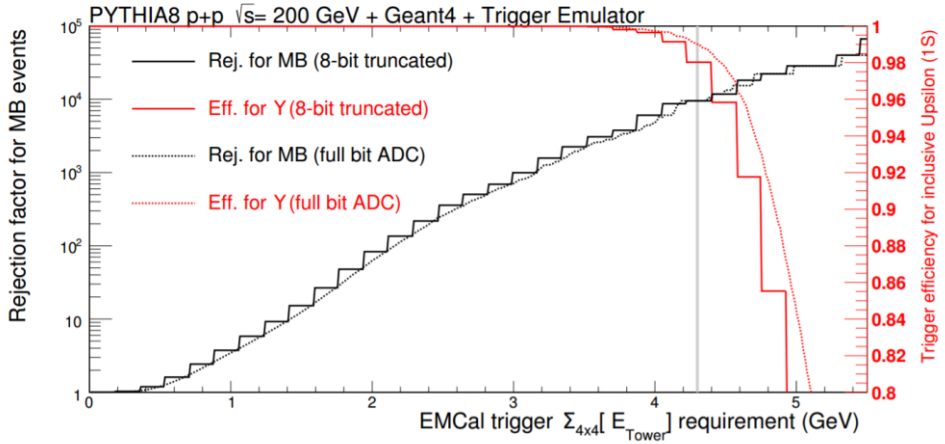
Sasha Lebedev (ISU)

Trigger rejection power (single 4x4 tower)

PHPythia8 MinBias events
(SoftQCD:nondiffractive = on)



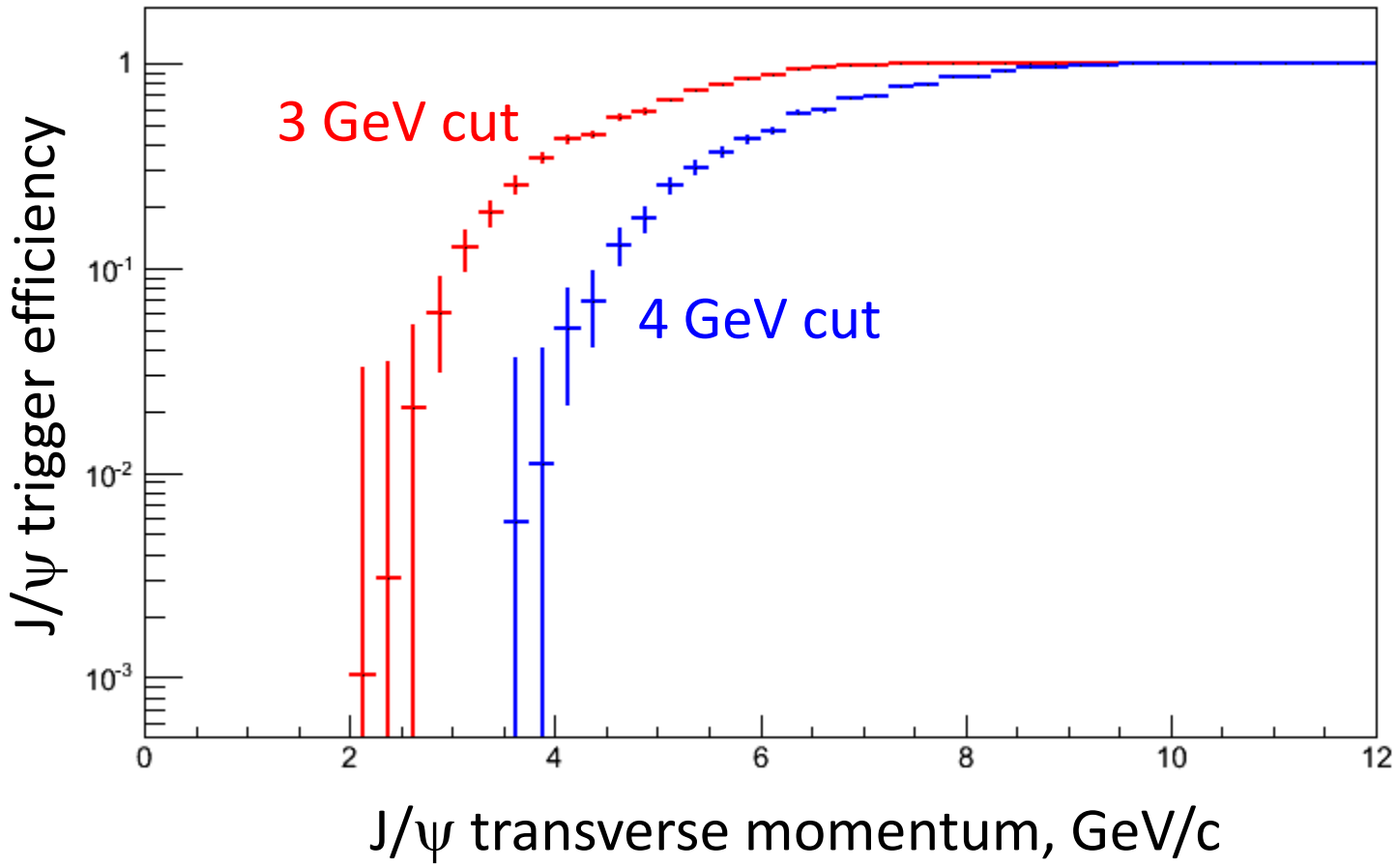
pre-CDR Fig. 5.29



Trigger definition:

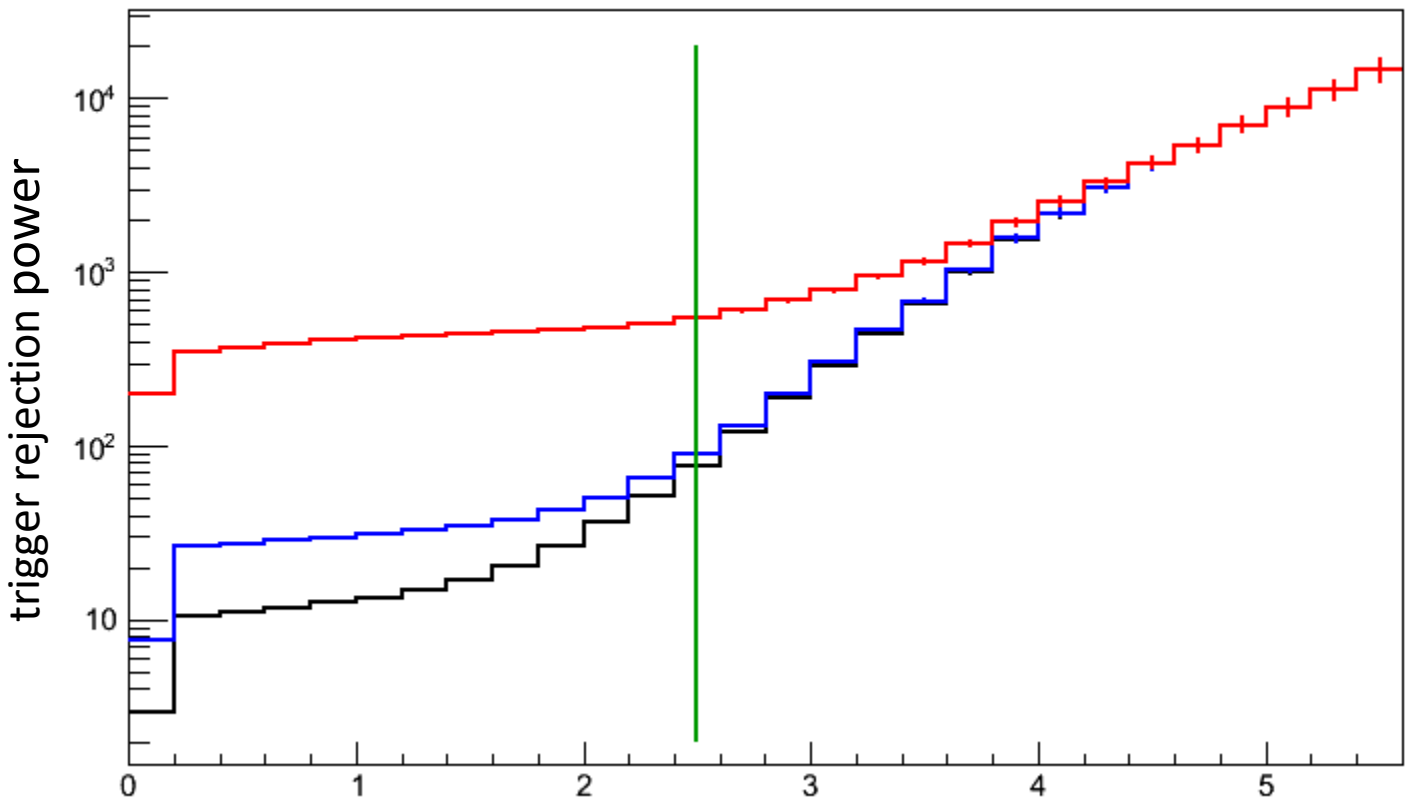
1. Go through all 4x4 tower combinations with step size of two towers.
2. Sum 8-bit truncated tower energy within the 4x4 towers, where
   8-bit truncated tower energy =
   floor(E_{Tower} / (50 GeV/256)) * (50 GeV/256).
3. Get the maximum (Sum 8-bit truncated tower energy within the 4x4 towers) in the event, cut on it.

Trigger efficiency for J/ψ (single 4x4 tower)



Can we get to lower p_T by using two-cluster trigger and cutting on invariant mass?

Two-cluster trigger rejection power



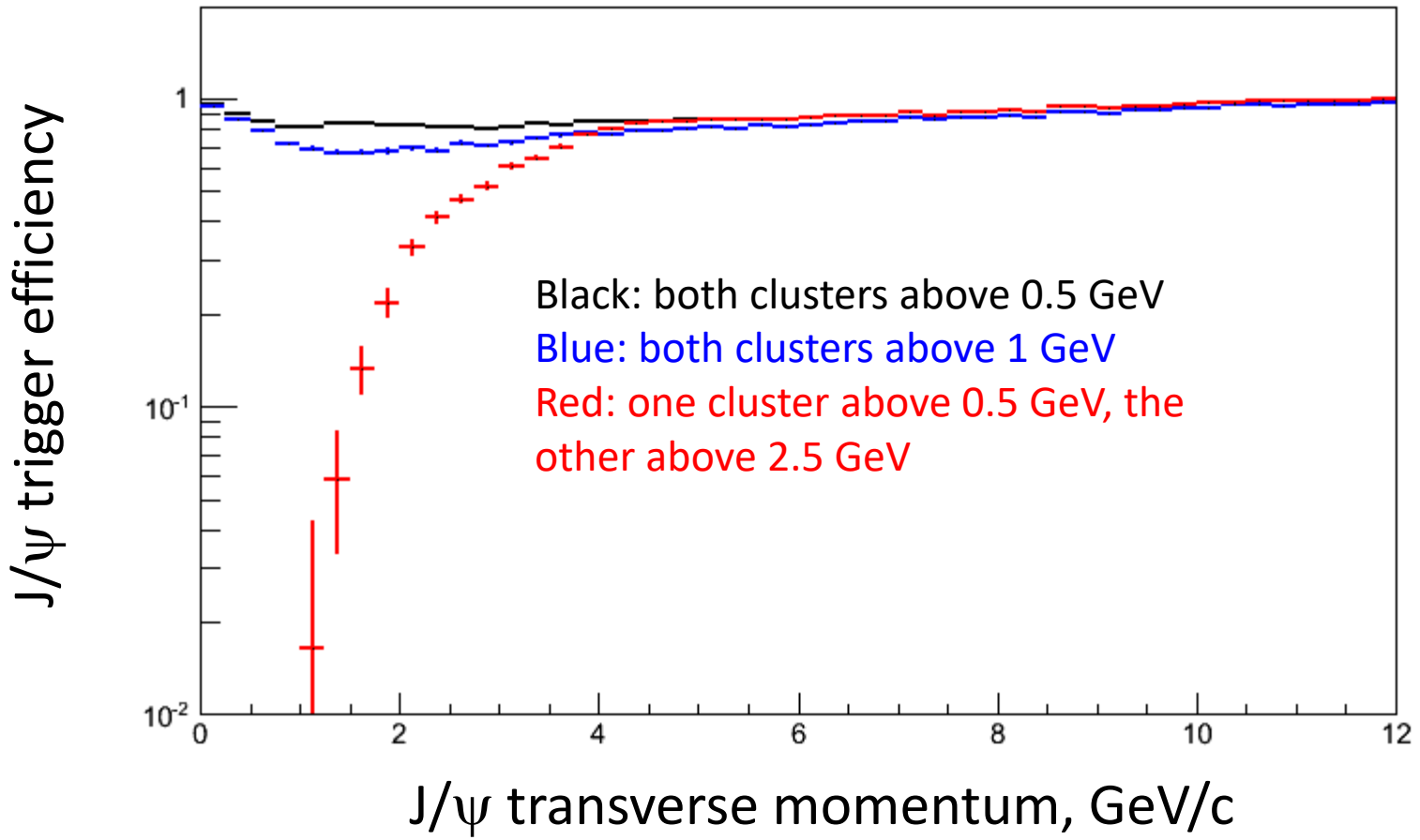
1. Select all 4x4 towers with truncated sum above certain threshold
2. Calculate invariant mass for all pairs
3. Select maximum invariant mass in an event, and consider trigger fired if it is above 2.5 GeV

Black: both clusters above 0.5 GeV

Blue: both clusters above 1 GeV

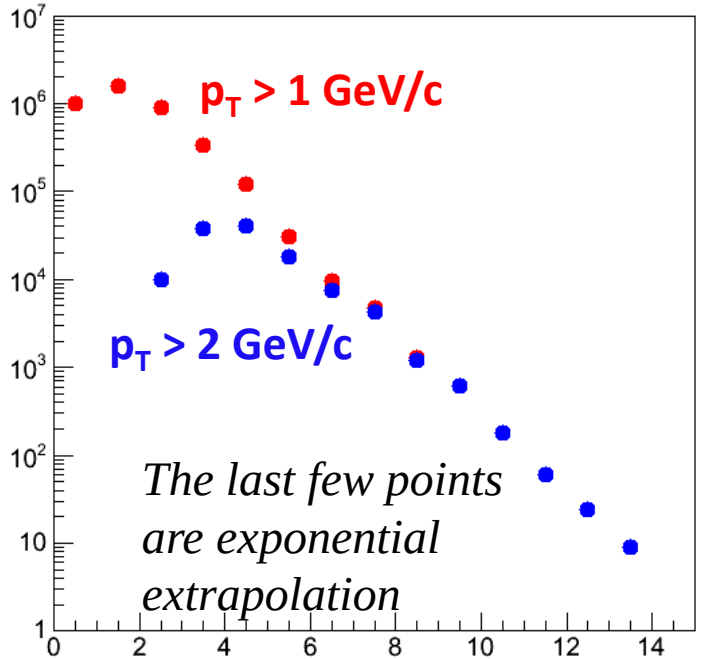
Red: one cluster above 0.5 GeV, the other above 2.5 GeV

Two-cluster trigger efficiency



Expected J/ψ yield in p+p

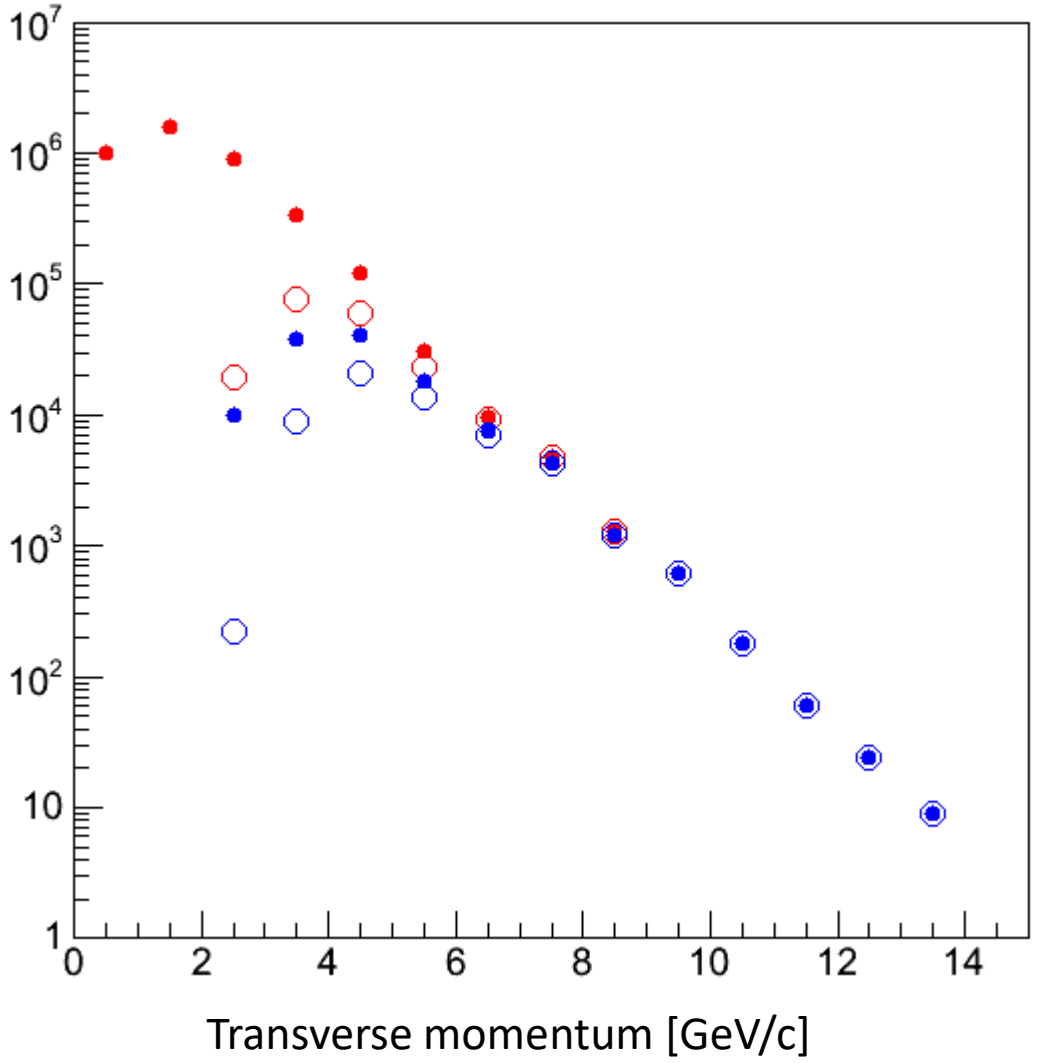
Expected number of J/ψ in 7350B p+p collisions



Number of p+p events	7350e+09
N_{COLL}	1
σ_{pp}	40 mb
$B_{ee} \times \sigma_{J/\psi}$	180 nb*
R_{AA} for J/ψ	1.0
Acceptance (PYTHIA)	0.224 (integrated over p_T)
eID efficiency	0.9
Tracking efficiency	100%
Number of reconstructed J/ψ in acceptance	6.6e+06
p_T > 1 GeV cut efficiency	59% (integrated over p_T)

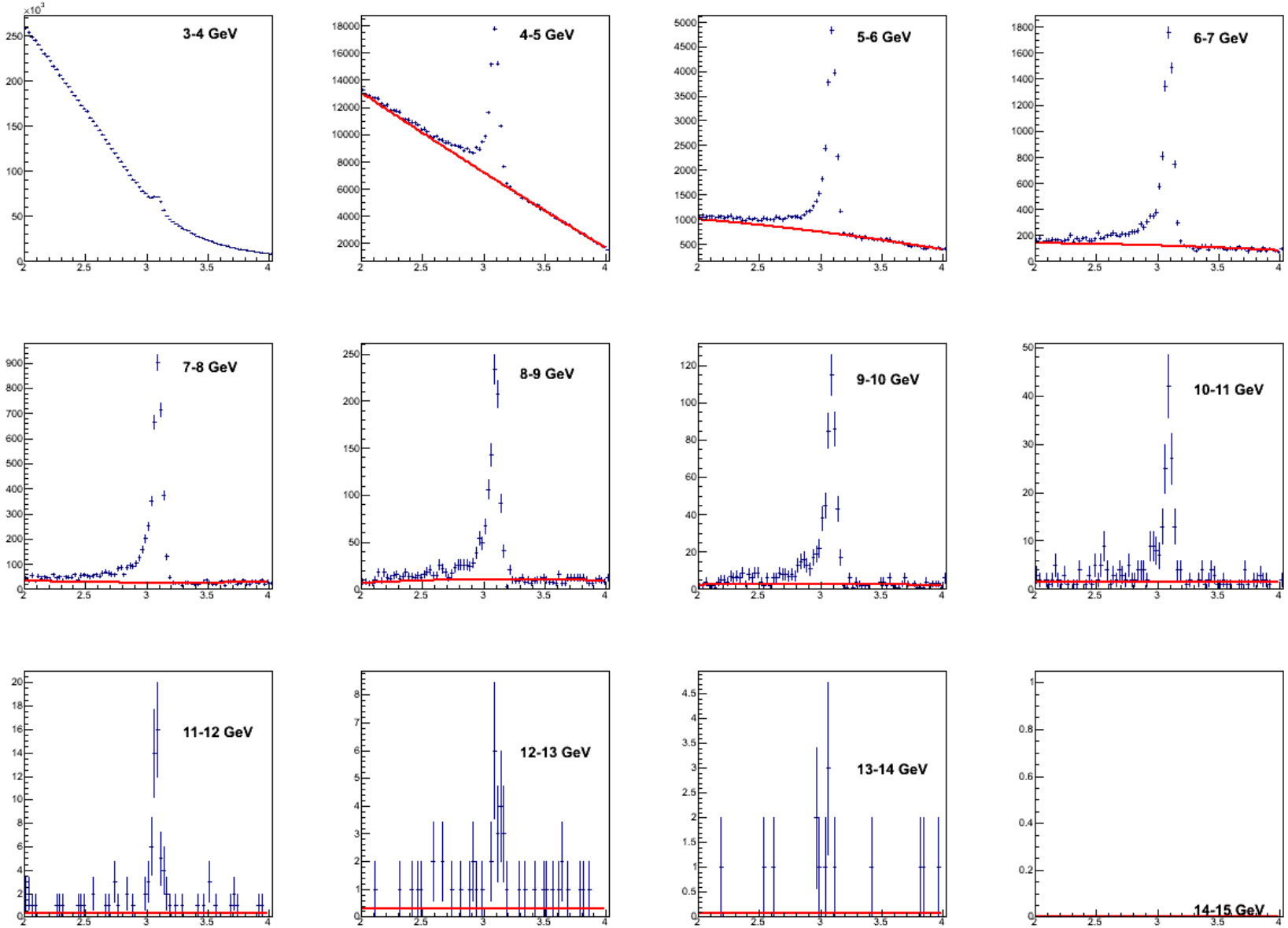
* ppg104; Phys. Rev. D85, 092004 (2012)

Expected number of J/ψ with trigger efficiency



Red: $p_T > 1$ GeV/c
Blue: $p_T > 2$ GeV/c
Solid symbols:
before trigger efficiency.
Open symbols:
including trigger efficiency (3 GeV cut).

Expected invariant mass distributions in p+p

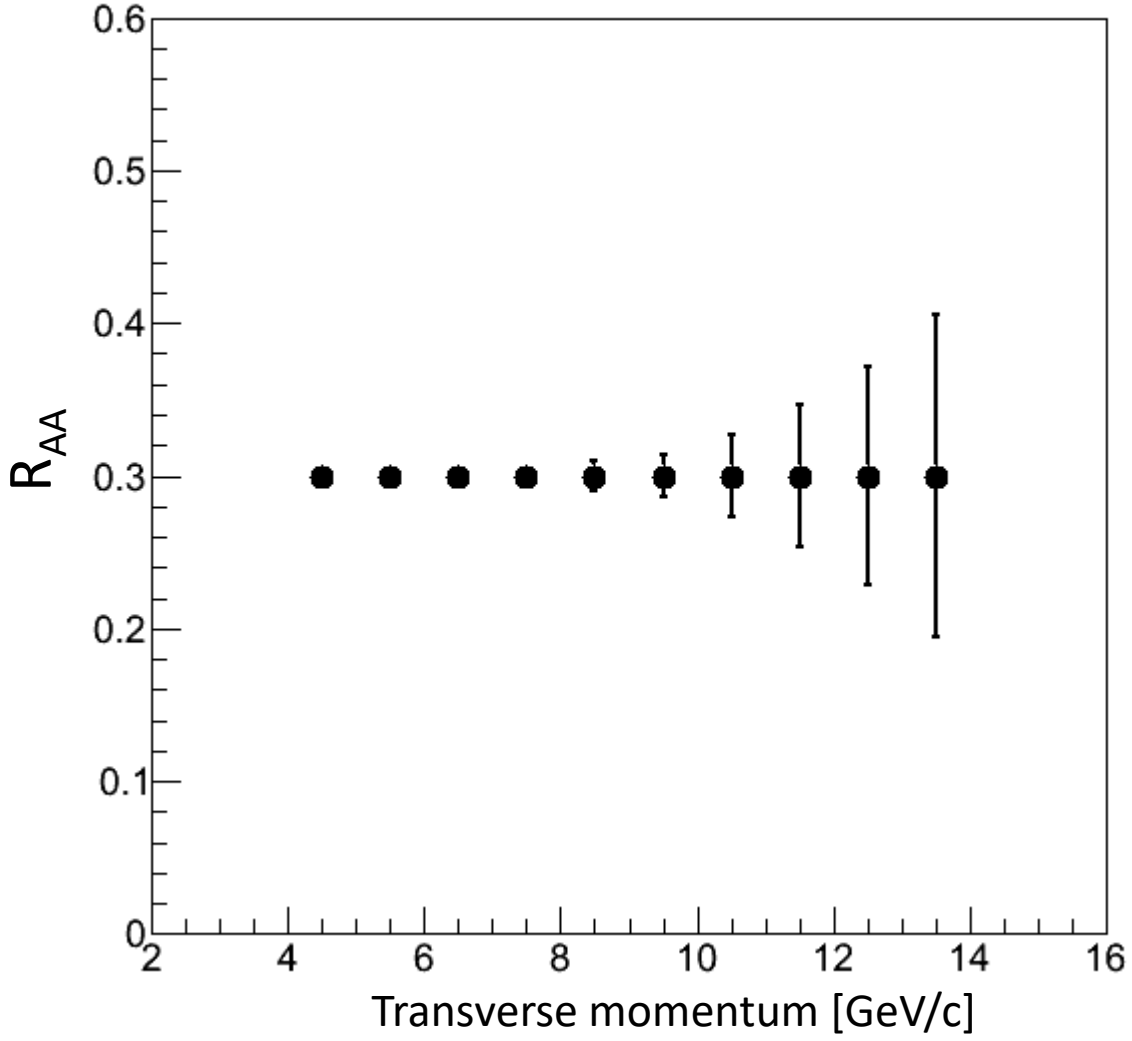


p_T > 1 GeV/c

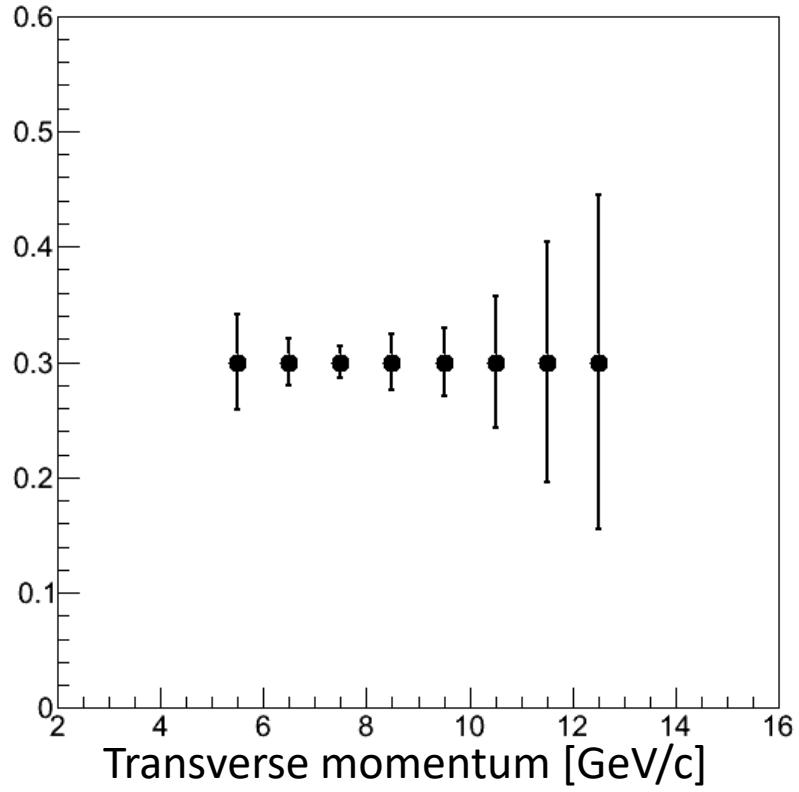
Same code used for Upsilons and J/ψ in Au+Au

Combinatorial background only.

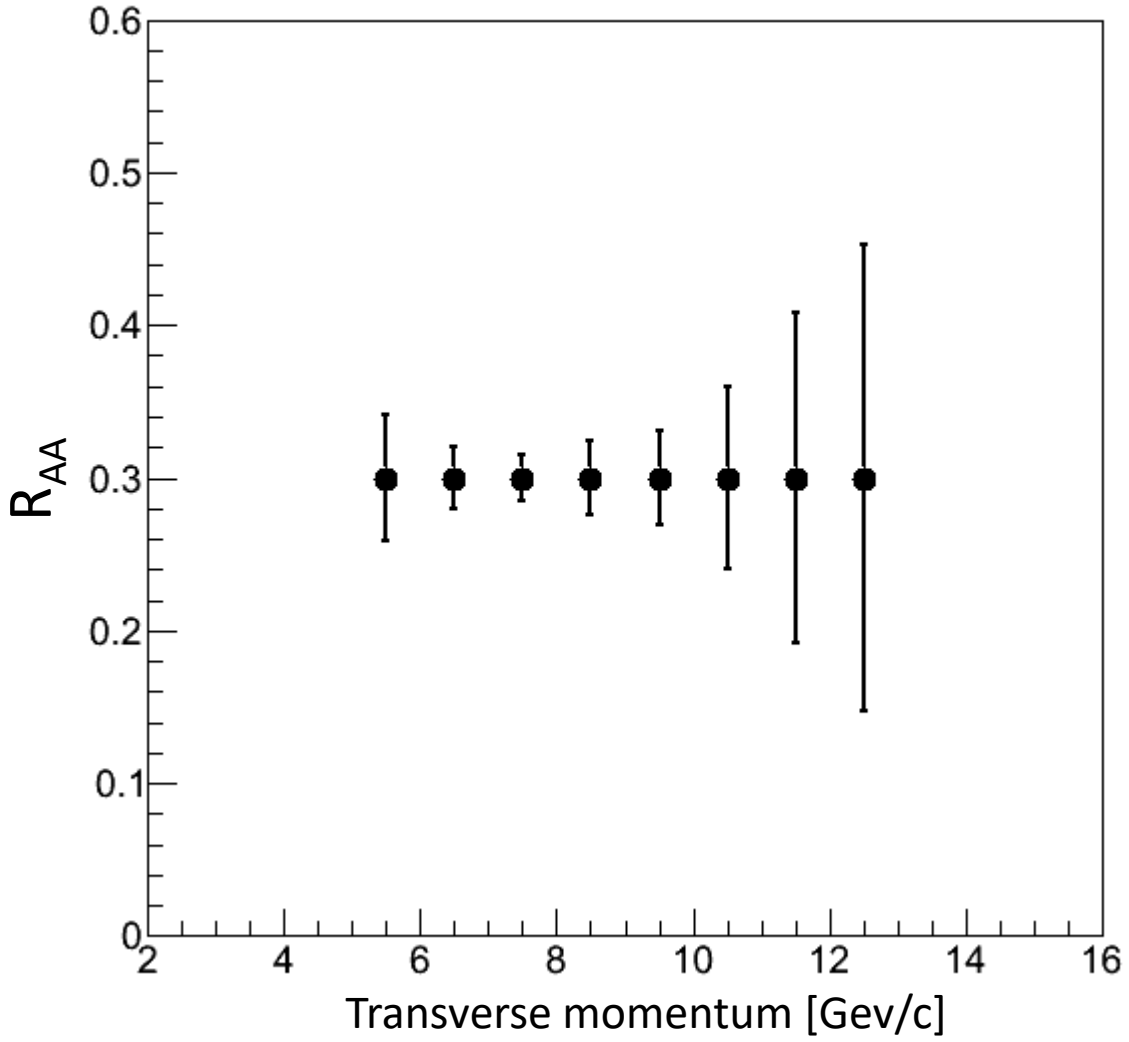
R_{AA} uncertainty from p+p measurement



R_{AA} uncertainty from just Au+Au



Final R_{AA} statistical uncertainty



The main source of statistical uncertainty of R_{AA} indeed comes from Au+Au measurement. p+p contribution is negligible except, maybe, the highest p_T point.